```cpp
class NumMatrix {
public:
    vector<vector<int>> sum;

    NumMatrix(vector<vector<int>>& matrix)
    {
        int row = matrix.size();
        int col = matrix[0].size();

           for(int i=0; i<row; i++)
           {
               for(int j=1; j<col; j++)
                   matrix[i][j] += matrix[i][j-1];

           }

        // FIND PREFIX SUM
         for(int i=1; i<row; i++)
           {
               for(int j=0; j<col; j++)
                   matrix[i][j] += matrix[i-1][j];

           }
        sum = matrix;
    }
```

```
    int sumRegion(int r1, int c1, int r2, int c2)
    {
        int total = sum[r2][c2];
        int extraSum = ( c1!=0 ? sum[r2][c1-1] : 0 ) +
                       ( r1!=0 ? sum[r1-1][c2] : 0 ) -
                       ( r1!=0 && c1!=0 ? sum[r1-1][c1-1] : 0 );

        return total-extraSum;

    }
};
```

★ Range Sum Query 2D - Immutable

	0	1	2	3	4
0	3	0	1	4	2
1	5	6	3	2	1
2	1	2	0	1	5
3	4	1	0	1	7
4	1	0	3	0	5

Q- Find the sum b/w range (2,1, 4,3)

(2,1) and (4,3)

2+0+1+
1+0+1+
0+3+0 = 8

(0,0) to (4,3) tak pucahai ques mein?

Approach:- Find the sum (0,0,4,3)

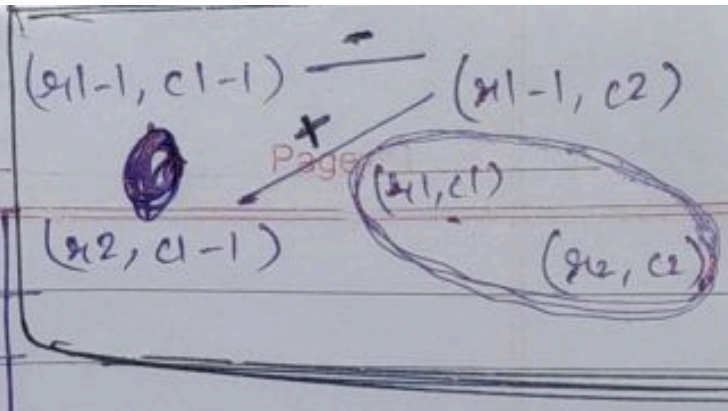
(1) Find prefix sum of all the columns

3	0+3	1+0+3	4+1+0+3	2+4+1+0+3
5	6+5	3+6+5	2+3+6+5	1+2+3+6+5
1	2+1	0+2+1	1+0+2+1	5+1+0+2+1
4	1+4	0+1+4	1+0+1+4	7+1+0+1+4
1	0+1	3+0+1	0+3+0+1	5+0+3+0+1

Date

Page

3	3	4	8	10
5	11	14	16	17
1	3	3	4	9
4	5	5	6	13
1	1	4	4	9



(2) Find Prefix sum for rows

	0	1	2	3	4
0	3	3	4	8	10
1	8	14	18	24	27
2	9	17	21	28	36
3	13	22	26	34	49
4	14	23	30	38	58

(2,1,4,3) Find?

(0,0,4,3)

Ans lies at (4,3) = 38

First Extra :- 24

Second Extra :- 14

24 + 14 − 8 = 30

38 − 30 = 8

★ Result b/w (r1, c1) and (r2, c2)

(2,1) (4,3)

(r2, c2) − ([r2, c1−1] + [r1−1, c2] − [r1−1, c1−1])

Sum :- 38 14 24 8

idx :- (4,3) (4,0) (1,3) 1,0